1 **(a) (i)** no reaction [1]

$Fe + Sn^{2+} \rightarrow Fe^{2+} + Sn$ / $2Fe + 3Sn^{2+} \rightarrow 2Fe^{3+} + 3Sn$ [2]
for realising that there would be a reaction shown by an attempt to write an equation e.g. writing Fe_2Sn etc. allow [1]

no reaction [1]

(ii) tin oxide, nitrogen dioxide (accept nitogen(IV) oxide/dinitrogen tetroxide), oxygen
All three for two [2]
accept correct formulae

any two correct products [1]

(b) (i) tin [1]

(ii) $4OH \rightarrow O_2 + 2H_2O + 4e$ [2]
not balanced allow [1]

(iii) sulfuric acid [1]

(c) zinc is more reactive than iron/steel [1]
tin is less reactive than iron/steel [1]

zinc corrodes/reacts/loses electrons/is oxidised/is anodic/provides sacrificial protection/ forms positive ions (in preference to iron or steel) ORA
allow iron is cathodic for this mark. [1]

Iron/steel corrodes/reacts/rusts/loses electrons/is oxidised/is anodic/forms positive ions (in preference to tin). ORA
allow tin is cathodic for this mark [1]

2 **(a)** **(i)** bauxite [1]

(ii) lowers melting point [1]
better conductor / reduces amount of energy needed / reduces cost / more economic / makes process viable / conserves energy [1]

(iii) aluminium more reactive than copper / aluminium higher in reactivity series [1]
hydrogen not aluminium formed at cathode [1]

(b) $Al^{3+} + 3e \rightarrow Al$ [1]
$2O^{2} \rightarrow O_2 + 4e$ [2]
note: not balanced = 1
oxygen reacts with carbon (anode) to form carbon dioxide / $C + O_2 \rightarrow CO_2$ [1]
note: if mark(s) for an electrode reaction are not awarded then allow aluminium ions accept electrons / are reduced [1]
oxide ion loses electrons / is oxidised [1]
max 4

(c) **(i)** protective oxide layer [1]

(ii) aluminium low density / light [1]
aluminium is a good conductor [1]
strength / prevent sagging / allows greater separation of pylons / core made of steel because it is strong [1]

3 **(a)** sodium is expensive / difficult to obtain sodium (from sodium chloride) / problems getting electricity / hard to extract sodium / high energy costs in extraction of sodium [1]

(b) **(i)** reduce temperature / reduce melting point (to 900/1000°C) temperature need not be stated, but if it is stated it must be within the range
better conductivity / solid aluminium oxide does not conduct
aluminium oxide is insoluble in water any **two** [2]

(ii) $2O^{2} \rightarrow O_2 + 4e$ [2] or

(iii) they burn (away) / react with oxygen / form carbon dioxide [1]

(c) hydrogen formed / aluminium above hydrogen in reactivity series / H^+ discharged in preference to Al^{3+} / aluminium is more reactive than hydrogen [1]
aluminium more reactive than carbon / carbon cannot reduce aluminium oxide / aluminium is higher than carbon in the reactivity series / carbon doesn't reduce aluminium oxide / carbon doesn't displace aluminium [1]
comparison is essential for mark

4 **(a)** **(i)** H_2 on RHS [1]
ignore any other species on RHS
rest of equation fully correct i.e. $2H^+ + 2e \rightarrow H_2$ [1]

(ii) $\underline{H^+}$ removed / escapes / discharged / used up / reduced [1]
(equilibrium) moves to RHS / more water molecules ionise or
dissociate / forward reaction favoured [1]

(iii) oxygen / O_2 [1]
not O

(iv) carbon / graphite / platinum (electrode) [1]

(b) **(i)** to make ammonia / in petroleum processing / balloons / rocket fuel / fuel for cars / hardening of fats / fuel cells / fuel (unqualified) / making hydrochloric acid [1]

(ii) to sterilise / disinfect it / kill bacteria / bugs / microbes / micro-organisms / germs [1]

(c) **(** (reference to) <u>volume</u> and time / how long it takes [1]

(ii) carry out experiment with different intensities of light / one in light and one in dark / repeat experiment in reduced light [1]
measure new rate which would be <u>fast**er** or slow**er**</u> depending on light intensity [1]

[Total: 11]

5 molten potassium iodide **NOT** aqueous [1]

hydrogen [1]
oxygen [1]
water used up **or** solution becomes more concentrated **or** sodium chloride remains
NOT no change [1]
If products are given as hydrogen, chlorine and sodium hydroxide then 2/3

copper [1]
oxygen (and water) [1]
sulfuric acid accept hydrogen sulfate [1]

aqueous **or** dilute **or** concentrated potassium bromide [1]
accept correct formulae

[Total: 8]

6 **(a) (i)** $2H^+ + 2e \rightarrow H_2$ [1]

(ii) $2Cl^- - 2e \rightarrow Cl_2$ **or** $2Cl^- \rightarrow Cl_2 + 2e$ [1]

(iii) Na^+ and OH are left [1]
OR Cl^- removed OH left
NB ions by name **or** formula essential
NOT any reaction of Na **or** Na^+
NOT Na^+ and OH combine

(b) sterilise/disinfect water **or** kill microbes/germs bacteria, etc. [1]
NOT just to make it safe to drink **or** purify it **or** clean it
treat above as neutral they do not negate a correct response

(ii) ammonia **or** methanol **or** hydrogen chloride **or** margarine [1]
NOT nylon

(iii) fat **or** lipid **or** triester **or** named fat **or** glyceryl stearate [1]
or vegetable oil
heat [1]

[Total: 7]